00 P1 A5	**5B** •1 $\{L = aL + 10 \text{ or } L = a^2L + 16\}$ or $\{L = \frac{b}{1-a}\}$ •2 $L = \frac{10}{1-a}$ or $L = \frac{16}{1-a^2}$ •3 $\frac{10}{1-a} = \frac{16}{1-a^2}$ •4 $10a^2 - 16a + 6 = 0$ •5 $a = \frac{3}{5}$ and $L = 25$
01 P2 Q3	**2C, 4C** •1 1.015 s/i by the start of (b) •2 $u_{n+1} = 1.015u_n - 300$ and initial value (eg $u_0 = 2500$) •3 u_1 i.e. £2237·50 •4 u_2 and u_3 i.e. £1971·06, £1700·63 •5 £286·38 •6 £290·68 for December payment ans: Dec 1st, £290·68
02 P2 Q4	**3C, 3C** •1 0.8 stated or implied •2 eg $l = 0.8l + 0.5$ or $l = \frac{0.5}{1-0.8}$ •3 $-1 < 0.8 < 1$ so $l = 2.5$ metres •4 $2 = 2m + 0.5$ •5 $m = 0.75$ •6 trim 25%
3. (JAN) 02 P2	**3C, 2C** •1 $-1 < a < 1$ stated explicitly •2 $l = 0.9l + 10$ or equiv. strat •3 $l = 100$ •4 10.9, 19.8, 27.8 •5 $u_7 = 52.65$ 10.9, 19.8, 27.8, 35.5, 41.54, 47.39, 52.65
03 P1 Q4	**2C, 2C** •1 $15 = 12p + q, 16 = 15p + q$ •2 $p = \frac{1}{3}, q = 11$ •3 e.g. $L = \frac{1}{3}L + 11$ •4 $L = 16\frac{1}{2}$
04 P2 Q4	**1C, 3B**

	•¹ $-1<k<1$ •² $l="\dfrac{b}{1-a}"$ *stated* •³ $5=\dfrac{3}{1-k}$ •⁴ $k=\dfrac{2}{5}$	**OR**	•² $L=kL+3$ *stated* •³ $5=5k+3$ •⁴ $k=\dfrac{2}{5}$
05 P1 Q6	**2C, 5B** •¹ $e.g.\ 4=k\times 4+5$ •² $k=-\frac{1}{4}$	**OR**	•¹ $4=\dfrac{5}{1-k}$ •² $k=-\dfrac{1}{4}$ **OR** •¹ $k=\dfrac{L-5}{L}$ •² $k=\dfrac{4-5}{4}=-\dfrac{1}{4}$
	•³ $u_1=3m+5$ •⁴ $u_2=m(3m+5)+5$ $\left(m(3m+5)+5=7\right)$ •⁵ $3m^2+5m-2=0$ •⁶ $(3m-1)(m+2)=0$ •⁷ $m=-2$		
06 P1 Q4	**1C, 2C** •¹ sequence has limit since $-1<0.8<1$ •² $L=0.8L+12$ •³ $\text{limit}=60$	**OR**	•² $L=\dfrac{12}{1-0.8}$ •³ $limit=60$
07 P1 Q7	**3C, 3C** •¹ $u_1=\frac{1}{4}u_0+16$ s/i by •² •² 16 •³ 20, 21 •⁴ $-1<\frac{1}{4}<1$ •⁵ $k=\frac{1}{4}k+16$ •⁶ $k=\dfrac{64}{3}$ *Alternative for •⁵ and •⁶* •⁵ $k=\dfrac{16}{1-0.25}$ •⁶ $k=\dfrac{64}{3}$		
11 P2 Q3	find terms of sequence interpret sequence solve for one variable state second variable		•¹ $u_1=8$ and $u_2=-4$ •² e.g. $4p+q=5$ **and** $5p+q=7$ •³ $p=2$ or $q=-3$ •⁴ $q=-3$ or $p=2$

	know how to find valid limit calculate a valid limit only state reason	•5 $l=-\frac{1}{2}l$ or $l=\frac{0}{1-\left(-\frac{1}{2}\right)}$ •6 $l=0$ •7 outside interval $-1<p<1$
13 P2 Q1	interpret recurrence relation interpret recurrence relation know to use simultaneous equation find m and c	•1 $7=4m+c$ •2 $16=7m+c$ •3 $7m+c=16$ $4m+c=7$ leading to •4 $m=3,\ c=-5$

ANSWERS PRE 2000 **Evaluating Terms and Limits**

1	•1 $-1<0\cdot3<1$ •2 $L=0\cdot3L+5$ *or* $L=\frac{b}{1-a}=\frac{5}{1-0\cdot3}$ •3 $L=\frac{50}{7}$
2	•1 $4\cdot7$ •2 7 •3 $l=0\cdot9l+2$ *OR* •3 $l=\text{“}\frac{b}{1-a}\text{”}=\frac{2}{1-0\cdot9}$ •4 20 •4 20
3	•1 Only V_n has a limit because $-1<0.3<1$ •2 e.g. use $L=aL+b$ •3 $L=\frac{40}{7}$ •4 evaluate enough terms to exceed 1000 •5 $u_7=1749.8$
4	•1 "$L=0.2L+p,\quad L=0.6L+q$" *or use* "$l=\frac{b}{1-a}$" •2 $\frac{p}{0.8}$ *and* $\frac{q}{0.4}$ •3 $p=\frac{0.8q}{0.4}$ or equivalent expression for p

ANSWERS PRE 2000 **Extended Questions**

1	(a) apply 1g wait a week = 1 **x 0.75** = 0.75g apply another 1g and wait a week = (0.75 + 1) x 0.75 = 1.31g apply another 1g and wait a week = (1.31 + 1) x 0.75 = **1.73g** apply another 1g and wait a week = (1.73 + 1) x 0.75 = 2.05 > 2g After 4 feeds the Bioforce becomes effective $u_{n+1}=(u_n+1)\times0.75=0.75\,u_n+0.75$ at the end of each week (before feeing).

	(b) $u_{n+1} = 0.75u_n + 1$, $u_0 = 0$ immediately after feeding (c) •5 $-1 < 0.75 < 1$ so sequence has a limit •6 e.g. $L = 0.75L + 1$ •7 $L = 4$ •8 Safe to continue
2	(a) •1 1.005 •2 £1000 + interest = £1005 •3 £1005 + £100 + interest = £1110.525 •4 £1537.93 (b) •5 complete another month •6 £2073.94 on Nov.1st (c) •7 $u_{n+1} = 1.005u_n + 100$ •8 u_n = amount on 1st day of each month •9 $u_0 = 1000$ (on 1st January)
3	•1 $0 \cdot 35$ stated or implied •2 $0 \cdot 35u_n + 500$ •3 $0 \cdot 15$ stated or implied •4 $0 \cdot 15u_n + 650$ •5 $l = al + b$......... or limit $= \frac{b}{1-a}$......... •6 limits = 769 and 765 •7 Limits are valid since $\lvert a \rvert < 1$ in both cases **and** Pestkill is more effective
4	(a) •1 strategy for each hour (e.g. using 0·85) •2 using strategy 4 times (e.g. ($0{\cdot}85^4$)) •3 13·05 (b) •4 apply a correct dose strategy •5 a relevant sequence e.g. 13·05, 19·86, 23·4, or 25, 38·05, 44·9, 48·4 •6 3 doses (c) •7 valid explanation i.e. $(0 \cdot 85)^4 = 0 \cdot 522$ explicitly stated (d) •8 statement that limit exists because $(0 \cdot 85)^4 < 1$ •9 $\therefore l = 0 \cdot 522l + 25$ **or** using $l = \frac{b}{1-a}$ •10 l = 52·3 •11 52·3 < 55 so no maximum length of time

5	(*a*) •1 0.6 stated/implied •2 $u_{n+1} = 0.6u_n + 2.5$ •3 communication: ie 6.25 $\Rightarrow$ danger (*b*) •4 $0.7 \times 2.5 = 1.75$ •5 2.8, 3.43, 3.808 •6 $u_{n+1} = 0.6u_n + 1.75$ •7 limit = 4.375 •8 communication: ie 4.375 $\Rightarrow$ allow/disallow
6	(*a*) •1 use 0.88 or 88% •2 $n = 6$ •3 $u_6 = 50 \times 0.88^6$ •4 23.22 (*b*) •5 adding 50 •6 $u_{n+1} = 0.88^6 u_n + 50$ •7 $-1 < 0.88^6$ (*or* 0.4644) < 1 so limit exists •8 $L = \frac{50}{1-0.88^6}$ •9 93.4 •10 $93.4 < 100$ so safe to continue
7	(*a*) •1 $u_n = 1.08^n u_0$ •2 $u_5 = 1.08^5 \times 50$ •3 73 or 74 (*b*) •4 $u_7 = 1.08^7 \times 50$ •5 $u_7 = 85$ or 86 •6 $v_n = 0.79^n v_0$ •7 $v_4 = 33$ or 34 •8 for consistent rounding
8	(*a*) •1 $u_0 = 20$ •2 $u_1 = 35$ •3 three further values eg 41.75, 44.78, 46.15 •4 46.76, 47.04, 47.17 looks like approaching a limit •5 five more lead to 47.27'something' $\Rightarrow$ limit = 47.27 (*b*) •6 $47.27 < 50$ so level safe